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present rate of consumption. The day does not seem distant, therefore, when these vast New Zealand deposits of high-grade ores will be appreciated and their utilization begun. I. B.

The Oceanic Languages, their grammatical structure, vocabulary and origin. By D. Macdonald, D.D., of the New Hebrides Mission, member of the Société d'Ethnographie, Paris. Henry Frowde: London, Edinburgh, Glasgow, New York, and Toronto, 1907. Pp. xv, 352, and two maps.

Not in the slightest degree indicated upon the title of this long-awaited contribution to our knowledge of the Western Pacific, the really important fact is that this work consists of a grammar and dictionary of the language of Efate in the New Hebrides. The author in his preface calls it in so many words "a complete dictionary of the language"; with more precaution and greater precision we may note from actual tally that the dictionary contains 3,657 entries. At last we have our first dictionary of any Melanesian language, the Fijian so interestingly recorded in Hazlewood's dictionary being a mixed speech in which the Polynesian element is preponderant. It has been a long wait. We have a Hawaiian dictionary published at Lahainaluna in 1845. Since that time the life of a man has passed before Melanesia receives something better than brief and irregular word-lists scattered through fugitive publications. Dr. Macdonald has been at work upon his task for thirty-five years, and he may well be proud that he has witnessed the production of this, the third and crowning volume of his studies upon the New Hebridean languages, the former volumes having been published in Melbourne in 1889 and 1891 at the charges of the Colony of Victoria, and the volume now in hand similarly appears through the generous liberality of the Commonwealth of Australia. We feel sure that Dr. Macdonald's admirably urged theory of the Semitic origin of the Malayo-Polynesian (including therein the Melanesian) will not be passed without a vigorous challenge from the philologists who specialize in that speech family or families. Yet even should the theory be overset and the comparative philological apparatus through which it is developed be cast aside as lumber, that does not in the least affect the value of the dictionary as our first vocabulary of Melanesian speech. The first ordered investigation of the complex of tongues in the western archipelagoes of the South Pacific was made by H. C. von der Gabelentz upon unfortunately scanty and not always accurate data and was published in 1861, when Dr. Macdonald was entering upon that life work so properly crowned with the bays by this monument of his own erection. Since then the only considerable addition has been Codrington's "Melanesian Languages" (1885) and that pretends to no more than comparative grammar. Our author has now produced the first dictionary, given us the first codified data, and thereby has made it possible to give intelligent study to the various scattered lists of words of the island area from New Caledonia to New Guinea. W. C.

Die Gletscher. Von Dr. Hans Hess, Königl-Gymnasial-Professor in Ansbach. With 72 figures (8 full-page half-tones) and four Maps. Braunschweig: F. Vieweg & Sohn, 1904.

The bibliography of glaciers comprises many titles, among which are several books from the times of von Böhm (1770) and de Saussure (1786) to the present day, but for twenty years the student has turned to A. Heim's "Handbuch der

Gletscherkunde" as a storehouse of fact and theory regarding glaciers. The advances, however, in knowledge during the time which has elapsed since the appearance of that book have been so great and so rapid that the appearance of the present work by Hess is a welcome addition to the literature of an interesting and difficult subject. Professor Hess has had wide and long-continued experience in work upon the ice-streams, which has been supplemented by the exhaustive reading characteristic of the German scientist.

The author first discusses with painstaking fulness the physical properties of ice, describing the crystalline form, the modes of occurrence, the "melting figures" of Tyndall, and the constants—plasticity, elasticity and behaviour under stretching and compression—receive particular attention on account of their bearing on the cause and manner of movement in glaciers. Hess, basing his conclusions upon microscopic study, adheres to the old theory that ice under pressure and with freedom to move behaves like wax, an idea that Chamberlin and Salisbury have opposed with the theory that the movement and change of form of the ice are due to sliding of the component crystals one upon another.

In discussing the climate of glacial regions attention is called to the lack of exact observation and measurement of snowfall upon the mountains and in the collecting fields of glaciers. Recent (up to 1903) observations in polar regions are brought together in valuable condensed form. The snow lines of all the glacial regions of the world are given upon an instructive map. It is interesting to note that nowhere in the northern hemisphere does the line of perpetual snow lie actually at sea-level. Even in Jan Mayen (82° N. Lat.) it is about 50 meters above the sea. The highest position of snow-level reported is that of 6,000 meters in the Kuen Lun Mountains in central Asia.

The extremes of the types of form presented by glaciers are the "Alpine" in which the upper surface of the ice is concave as it issues from its collecting ground, and the "continental" in which the upper surface is convex; but there are all kinds of transition forms between the ends of the series. The Alpine type is the more productive of glacier "tongues" extending downward from the ice sheet. The snow line separates every glacier into two parts, that of growth and that of dissipation, and the relation between these zones in the same glacier varies with the shifting of the snow-line—accurate maps, therefore, are of the greatest use to the student of glaciers in making out these relations.

After discussing briefly but clearly the distribution and dimensions of glaciers throughout the world, Professor Hess collects into a table the ice-covered land areas and states that glaciers of one kind and another cover about 15,200,000 square kilometers, or about 3 per cent. of the entire surface of the earth, or 10 per cent. of the land surface. Of course by far the largest part of the glacial coating is in the polar regions, and particularly the south polar (13,000,000 square kilometers). The glaciers of the mountains of the temperate and tropical regions occupy only 70,000 square kilometers, or less than one-half of one per cent. of the whole glacial area of the world. A chapter is devoted to the flow of glaciers, in which it is shown that, while the old method of measurement by means of lines of stones has not been improved upon for rough or average statistics, trigonometric methods can be applied where more exact work is demanded. Such methods have added much to our knowledge of the variation of the velocity of glacial movement with the breadth and depth of the ice-mass, with the inclination of the bed and in different parts of the length. The many tables given in this discussion compiled from the author's own observations and other sources are noteworthy. Many close analogies are pointed out between the flow of the ice of a glacier and that of the water of a stream.

Professor Hess contends that the whole complex structure known as the banding of a glacier merely expresses the stratification produced in the snow of the firn field, as modified by the changing circumstances of the glacier's bed. The chapter on the effects of the ice upon its rock bed shows that the author does not agree with those who have been trying to prove, of late years, that glaciers are weak and inefficient instruments of erosion.

A simple and condensed scheme of classification of moraines is presented, which may be translated as follows, the terms being fairly self-explanatory:

- Moraines
  - Transported moraines
    - Surface moraines
      - Side moraines
      - Middle moraines
    - Included moraines
    - Ground moraines
  - Lifted or erosion moraines
    - Wall moraines
      - Longitudinal moraines
      - Terminal moraines
        - Border moraines
        - Shoved moraines
    - Ground-moraine-covering.

Annual and secular variations of glaciers receive elaborate attention and Hess discusses at length the effects of climate, holding that differences and changes in climate do not alone account for the advance and retreat of the ice streams. He goes on then to show that the orographic relations of the glaciers have an important influence upon the question. The chapter upon the theories of glacier-movement is comprehensive and illuminating, giving a concise summary of the views of eminent glacialists from Scheuchzer to Forel and Finsterwald, including the mathematical expression given by Finsterwald to the Forel-Richter theory. The author devotes a chapter to the Glacial Period, particularly to the phenomena of that time in the region of the Alps, but with some reference to the remainder of Europe and the world in general. In discussing the causes of this period, Hess defends the idea that glacial periods must have come contemporaneously over the whole earth, and that the Great Ice Period was essentially continuous. After giving briefly the astronomical, geological and physical theories that have been advanced to account for the occurrence of general glacial periods and dwelling particularly upon the theories of de Marchi, Arrhenius and Marsden Manson, Hess concludes his masterly book by saying that the cause of the Glacial Period will be discovered when we have learned the true climate relations of existing glaciers and their action. E. O. H.

Vancouver's Discovery of Puget Sound. Portraits and Biographies of the Men Honored in the Naming of Geographic Features of Northwestern America. By Edmond S. Meany.

xvii and 344 pp., Illustrations, Maps, Charts, Appendix, and Index. The Macmillan Company, New York, 1907.

This book is a welcome accession to the library of North American exploration because the author sought unceasingly to obtain new information with regard to the work of Vancouver and his contemporaries from the public and private archives of England and Spain. He has brought together many facts that help to verify or explain obscure or disputed points; has collected the portraits of many men who furthered geographical enterprise on the Pacific Coast, and tells in foot-